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Abstract

Three projects were designed to develop and evaluate materials for use with aphasic children (perceptually handicapped with language problems). The first project presented stimulus pairs in varying modality conditions. Results suggested that, although the aphasic children were not capable of improving their auditory discrimination performance, they had some ability to improve discrimination performance in the visual and especially in the combined modalities. The second project, ongoing when reported, studied the nature of auditory sequencing abilities in an optimally controlled environment and explored means of improving those abilities. Stimuli were presented in successive auditory, simultaneous auditory, or successive visual conditions; intensity, inflection, and configuration were varied. The third project, also ongoing, developed instructional materials making maximal use of visual stimuli with primarily auditory programs designed to provide phrase structure and appropriate units. Appendixes, comprising over half of the document, report on the form program, the sequencing stimuli and equipment, teaching programs, and stimulus items and scoring forms. (JD)

INTERIM REPORT
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MODALITY CONTROLLED PROGRAMMED INSTRUCTION FOR PERCEPTUALLY HANDICAPPED CHILDREN WITH LANGUAGE DIFFICULTIES

February 1967

U.S. DEPARTMENT OF
HEALTH, EDUCATION AND WELFARE

Office of Education
Bureau of Research

INTERIM REPORT ON PROGRAMMED INSTRUCTION FOR PERCEPTUALLY HANDICAPPED CHILDREN WITH LANGUAGE DIFFICULTIES

Project No. 6-8527
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Joel Stark

February, 1967

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Stanford University
Stanford, California

CONTENTS

INTRODUCTION

This project was undertaken at the Institute for Childhood Aphasia for the primary purpose of developing and evaluating materials which could be used to train perceptually handicapped children with language difficulties . As a group, these children failed to develop appropriate verbal language yet demonstrate evidence for relatively good physical, intellectual, and social development. They have been described by several writers (Benton, 1963; Eisenson, 1963; West, 1962; Wood, 1964; Myklebust, 1954). However, with the exception of the method proposed by McGinnis (1963), there has been no systematic training procedure reported.

The children are referred to as "aphasic" and each fulfilled the following criteria:

1. Deficit in the manipulation of spoken language.

2. Evidence of perceptual and/or behavior disturbance which militated against efficient learning.

3. Demonstrable neurological deficit and/or birth and developmental history which presumes organic involvement.

4. Evidence of normal or near normal intelligence on non-verbal tests.

When a child is classified as aphasic, he is included in the experimental training program which has been conducted for about three years. Ordinarily, the program is restricted to children between three and eight years of age.

While it is difficult to generalize from child to child with regard to treatment procedures, we have found that the most effective approaches are those which utilize the learning principles which were originally espoused by Skinner (1938) and have had an increasingly successful application in a variety of clinical and experimental settings (Krasner and Ullman, 1965; Honig, 1966). When the conditions are arranged so that a child is presented with tasks at which he can succeed, and the reinforcement which follows an appropriate response strengthens the behavior, optimal learning occurs.

Aphasic children are exceedingly difficult to motivate. Many manifest behaviors which have been described with terms such as distractibility, hyperactivity, and impulsivity. The syndrome of perceptual and behavioral deviations concomitant with central nervous system has been described elsewhere (Birch, 1964; Clements, 1966). Aphasic children do present symptomatology which makes it very difficult for them to be managed in a regular classroom. Even when they are assigned to special classes or placed in smaller groups, their training is often a challenge for the most experienced teacher.

In generalizing about the conditions under which the training would be most effective, we would include the following:

1. When maximal use is made of the child's relative strength in the visual modality.

2. When motor responses are modified. Sometimes these children have a perceptual competence which is not revealed because the response mode is too complex (i.e., they may "perceive" a figure but be unable to reproduce it with a pencil).

3. When materials are presented in carefully graded sequences so as to make it likely that these children will have as many positively reinforced responses at each level.

4. When the learning situation and physical environment are highly structured and distraction free.

5. When the stimuli are presented in a more "intense" manner (i.e., louder voices, fewer words, bolder print) so that attention to the task can be more easily given.

One part of the project has been concerned with an investigation of the auditory and visual discrimination learning abilities of the aphasic child. This involves automated equipment in an experimental setting in which the stimulus variables are more carefully controlled. The other aspect deals with our efforts to develop teaching programs along modality controlled lines for use in educational settings.

The work has been conducted by the staff of the Institute for Childhood Aphasia. In this report, three projects are described as follows:

Project I - An Investigation of Operant Conditioning Techniques in Multi-Modal Discrimination Learning

This study was undertaken by Michael May as his doctoral dissertation. The data has been collected and analyzed. Submission of the manuscript to a professional journal is contemplated soon.

Project II - An Investigation of Auditory Sequencing Ability

This study, presently underway, was an outgrowth of some earlier pilot studies of sequencing ability which are described in this report. The investigators include Michael May and Roger Poppen.

Project III - Development and Evaluation of Teaching Programs Which Maximize the Use of Visual Stimuli

This project is being conducted by the clinical staff at the Institute. A report on the form discrimination program by Robert Gottsleben is in Appendix A. The programs in Appendix C were developed by Carol Foster, Jane Giddan and Teris Wright.

PART II

AN EXPERIMENTAL STUDY OF [illegible] IN [illegible]

Background

[illegible] by Dr. Rachel May. It was undertaken to assess [illegible] auditory, visual, and combined (auditory-visual) paired associate learning rates for aphasic children. Previous studies (Cruickshank, Bentzen, Ratzeburg, and Tannhauser, 1961; Eisenson, 1954; Myklebust, 1954; Wepman, 1951) have also noted the auditory and visual perceptual problems of children with developmental or congenital deviations of the central nervous system. A factor which is crucial to their habilitation is the discovery of the modalities which are least impaired so that these can be used for teaching them language. It has been suggested by Birch and Belmont (1964) that training an aphasic child in a single modality rather than through multiple modality stimulation may be more efficacious. The implications for training are clear. If the aphasic child perceives better with a single input modality is used, the approaches used in teaching would naturally exclude multi-modal stimulation. It is essentially on this point that Mr. May's study addressed itself.

In reviewing the literature, there are studies done which indicate that aphasic children may have marked deficiencies in auditory and visual perceptual functioning (Wilson, Doehring and Hirch, 1960; Wepman, 1960). However, using operant conditioning techniques McReynolds (1966) was able to elicit certain performance in sound discrimination. While the aphasic children frequently failed to reach criterion on a task in which sounds were imbedded in a phonic context, there were no significant differences in their ability to discriminate between isolated speech signals. The McReynolds study (1966) which was done at the Institute for Childhood Aphasia was the prototype for the present experiment. However, in addition to determining whether aphasic children, given sufficient trials, can learn to discriminate between sounds in context, the questions included:

1. Can aphasic children discriminate between random geometric forms?

2. Can aphasic children learn to discriminate between simultaneous presentations of sounds-in-context and visual forms?

3. Can aphasic children discriminate uni-modal stimuli more effectively than the combined modalities stimuli?

Method

The experimental design called for the following:

1. Four different but theoretically equated stimulus pairs were presented in each stimulus modality condition. Each subject received three of these different stimulus pairs; one on each of the first three tasks. The stimulus items for task four (transfer task) were the addition or subtraction of one modality condition. Each stimulus pair (or combination of two pairs) occurred once in each task for the auditory and visual modality condition and twice in each task for the combined modalities condition.

2. The four stimulus pairs in each modality condition were presented in a different order (randomized) from task to task for each child.

3. Nonsense type stimuli rather than familiar type stimuli were presented in each modality. Auditory stimuli were chosen on the basis of their distinctive features and embedded in a nonsense phonetic context. The visual stimuli were random geometric shapes similar to those used by Withrow (1963).

Matched pairs of aphasic and normal children were randomly divided into sixteen (16) experimental conditions (see Appendix A, Figure 1). On the first and on the second day the children received one hundred (100) trials. Two hundred (200) trials (Task 3 and Transfer Task) were presented on the third day of testing. The procedure consisted of the predetermined random presentation of one hundred (100) stimuli, the order of which remain the same for all tasks and for all subjects. The one hundred (100) stimuli in each task were composed of fifty (50) of each member of the stimulus pair. Stimuli were presented continually until the subject responded by pushing either of two levers. Auditory stimuli were presented at second and one-half intervals, and visual stimuli remained projected until a response was made.

Correct responses were reinforced by a feeder mechanism which provided trinkets, candies, or paper clips. After each response, the stimulus was terminated and there was an inter-trial interval of 2.5 seconds prior to the presentation of the next stimulus. Incorrect responses were not reinforced.

The stimulus modality condition (auditory, visual, combined) remained the same for the first three hundred (300) trials although different pairs of stimuli were presented for each one hundred (100) trial tasks. The transfer tasks (final one hundred (100) trials on

Figure Ia

A REPRESENTATION OF THE TASKS IN THE AUDITORY AND VISUAL EXPERIMENTAL CONDITIONS

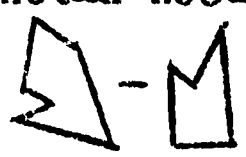
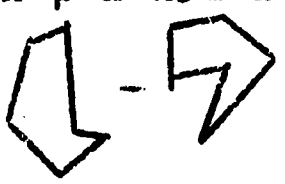
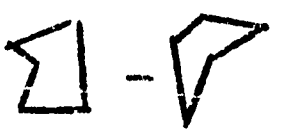
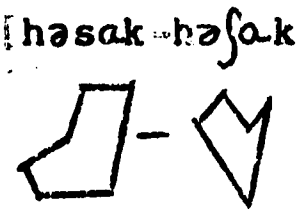
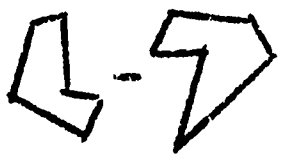
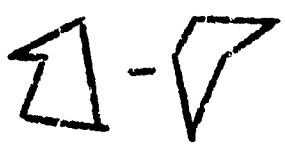
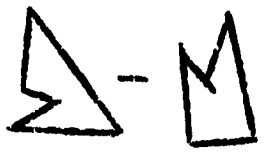
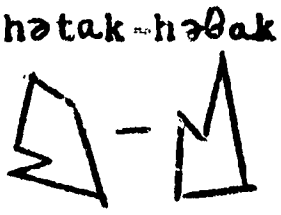
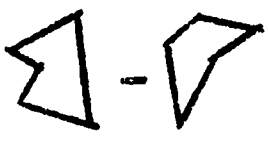
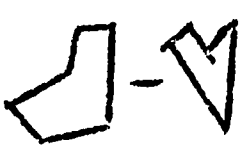
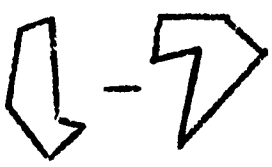
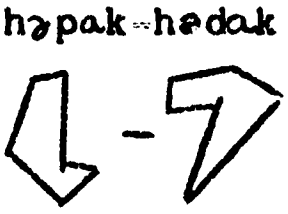
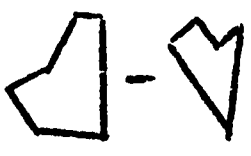
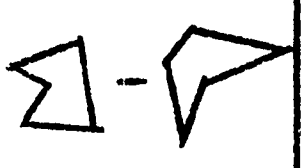
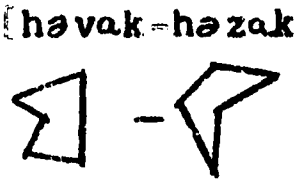
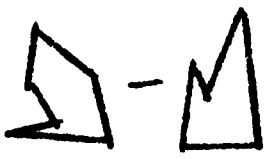
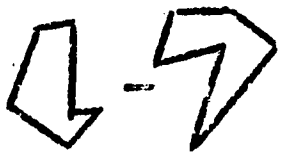
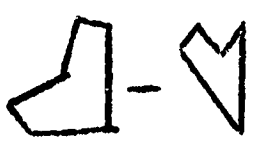
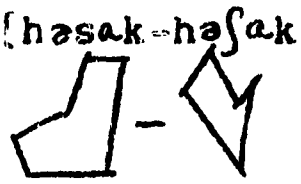
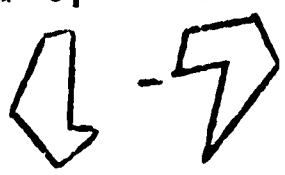
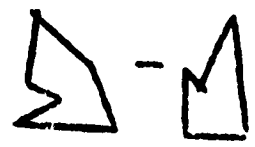
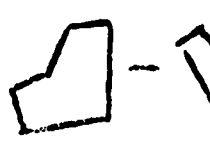
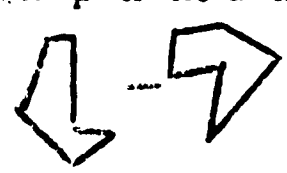
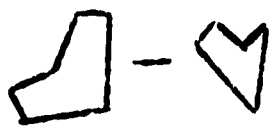
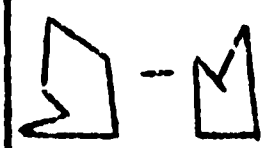
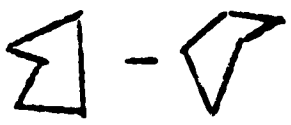
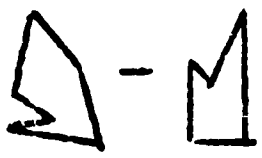
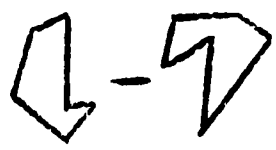
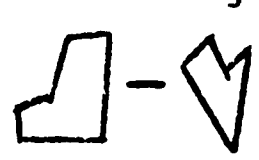
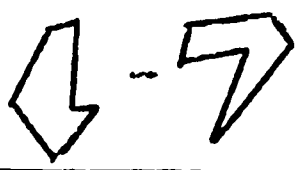
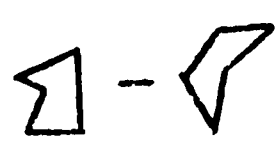
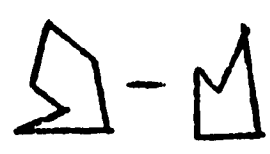
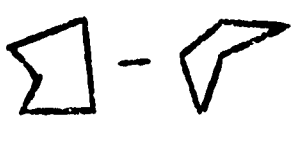
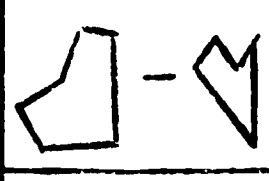
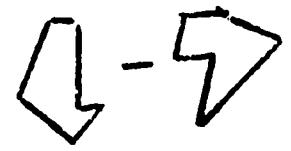
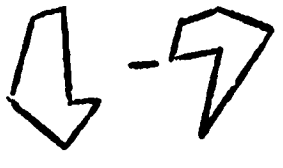
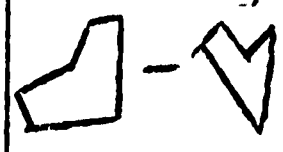
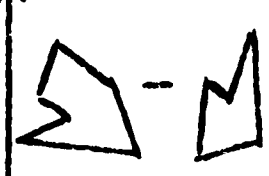
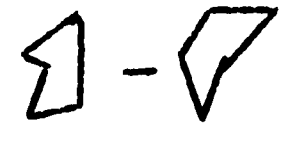
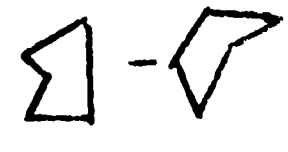
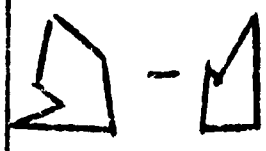
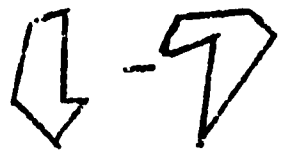
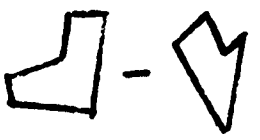
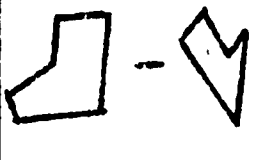
MODALITY CONDITION		TASK 1	TASK 2	TASK 3	TRANSFER TASK
AUDITORY	1	[həpak-hədak]	[həvak-həzak]	[hətak-həθak]	[hətak-həθak] 
	2	[həvak-həzak]	[həsak-həʃak]	[həpak-hədak]	[həpak-hədak] 
	3	[həsak-həʃak]	[hətak-həθak]	[həvak-həzak]	[həvak-həzak] 
	4	[hətak-həθak]	[həpak-hədak]	[həsak həʃak]	[həsak-həʃak] 
VISUAL	5				[hətak-həθak] 
	6				[həpak-hədak] 
	7				[həvak-həzak] 
	8				[həsak-həʃak] 

Figure 1b

A REPRESENTATION OF THE TASKS IN THE COMBINED EXPERIMENTAL CONDITIONS

MODALITY CONDITION		TASK 1	TASK 2	TASK 3	TRANSFER TASK
COMBINED	9	{həpak - hədak} 	{həvak - həzak} 	{hətak həθak} 	{hətak - həθak}
	10	{həvak - həzak} 	{həsak - həʃak} 	{həpak - hədak} 	{həpak - hədak}
	11	{həsak həʃak} 	{hətak - həθak} 	{həvak - həzak} 	{həvak - həzak}
	12	{hətak həθak} 	{həpak - hədak} 	{həsak - həʃak} 	{həsak - həʃak}
	13	{həpak hədak} 	{həvak həzak} 	{hətak həθak} 	
	14	{həvak həzak} 	{həsak - həʃak} 	{həpak - nədak} 	
	15	{həsak - həʃak} 	{hətak - həθak} 	{həvak - həzak} 	
	16	{hətak - həθak} 	{həpak - hədak} 	{həsak - həʃak} 	

the third day) either presented in additional modality (e.g., in going from auditory into combined, or in the case of a subject who had a combined presentation, presented only one of two previously concomitant stimulus pairs (e.g., in going from combined to auditory).

A block design of the experimental layout is shown on Figure 2.

Results

The mean per cent correct scores for the aphasic children in each condition and the analysis of variance summary tables are presented on Tables I, II and III. Below are some of the findings for the different tasks in each experimental condition:

1. Auditory discrimination performance by tasks revealed that two out of four aphasic children demonstrated the required auditory discrimination based on 100 trials for tasks 1, 2 and 3.

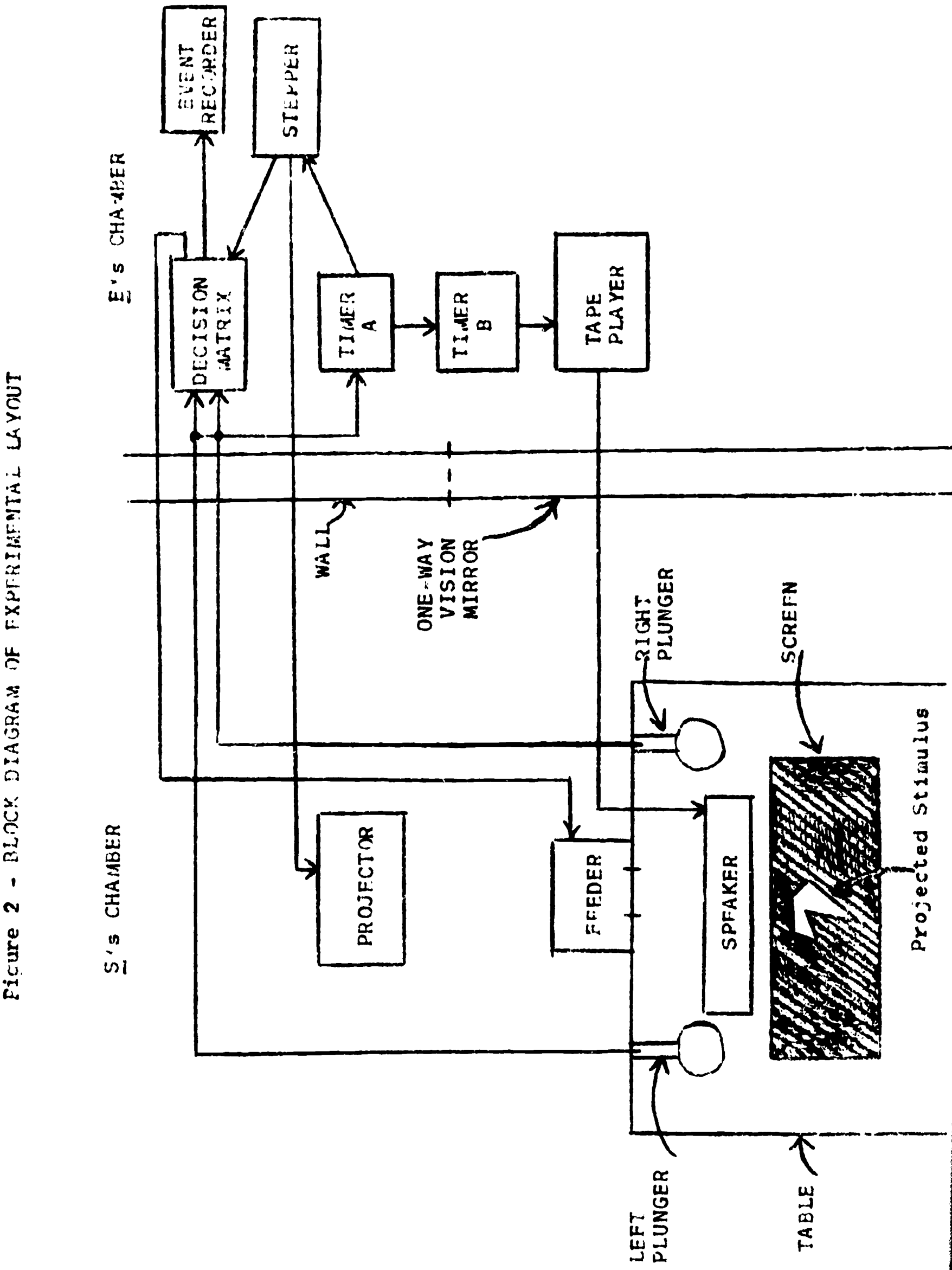
2. For the visual discrimination performance by tasks, no aphasic children demonstrated the required visual discrimination for task 1, two out of four demonstrated the required visual discrimination on task 2, and three out of four on task 3.

3. On the combined auditory and visual discrimination performance by tasks, five out of eight aphasic children demonstrated the required combined discrimination based on one hundred (100) trials on task 1, six out of eight on task 2, and seven out of eight on task 3.

4. On the tests vs. transfer tasks, three out of four aphasic children demonstrated the required combined discrimination based on one hundred (100) trials on transfer task I, three out of four on transfer task II, two out of four on transfer task III, and three out of four on transfer task IV.

5. In the auditory modality condition, aphasic children as a group evidenced a mean per cent gain of 2.25 from task I to task II, and a mean per cent loss of 9.25 from task II to task III. In going from the auditory condition to transfer task I, aphasic children as a group evidenced a mean per cent gain of 12.6. These differences were not statistically significant at the .05 level of confidence.

Figure 2 - BLOCK DIAGRAM OF EXPERIMENTAL LAYOUT



[illegible]	[illegible]	[illegible]	75.25

[illegible]

SOURCE	[illegible]	[illegible]	MEAN SQUARE	F
[illegible]	[illegible]	[illegible]		
Tasks	[illegible]	4	465.5	1.09 (NS)
Subjects	[illegible]	5		
Tasks x Subjects	[illegible]	20	425.85	3.69**
Residual Error	[illegible]	48	115.42	

With d.f. = 4, 20 a critical F score of 5.14 would have attained significance at the five per cent level of confidence.

** Significant beyond .01 level.

TABLE II

MEAN VISUAL SEARCH CORRECT SCORES
FOR ATYPICAL EMPLOYEES

Task 1	Task 2	Task 3
50.75	64.75	79.5

Two-Way Analysis of Variance

SOURCE	SUM OF SQUARES	d.f.	MEAN SQUARE	F
Total	20,524	59		
Tasks	8,301	2	4150.5	3.74 (NS)*
Subjects	6,788	3		
Tasks x Subjects	6,665	6	1110.83	7.88**
Residual Error	6,770	48	141.04	

With d.f.=2,6 a critical F score of 5.14 would have attained significance at the five per cent level of confidence.

*Significant beyond .10 level
**Significant beyond .01 level

TABLE XXI

MEAN COMBINED PER CENT CORRECT SCORES FOR APHASIC CHILDREN

Task 1	Task 2	Task 3
78.125	78.625	85.5

Two-Way Analysis of Variance

SOURCE	SUM OF SQUARES	d.f.	MEAN SQUARE	F
Total	46,533	119		
Tasks	1,360	2	680	1.73 (NS)
Subjects	33,258	7		
Tasks x Subjects	5,515	14	393.93	5.91**
Residual Error	6,400	96	66.67	

With d.f.=2,14 a critical F score of 3.74 would have attained significance at the five per cent level of confidence.

**Significant beyond .01 level

6. In the visual modality condition, aphasic children as a group evidenced a mean per cent gain of 16 from task I to task II and a mean per cent gain of 12.75 from task II to task III. In going from visual condition to transfer task II, aphasic children as a group evidenced a mean per cent gain of 16.6. These differences were not statistically significant at the .05 level of confidence.

7. In a combined modality condition, aphasic children as a group evidenced a mean per cent gain of .5 from task I to task II and a mean per cent gain of 6.9 from task II to task III. In going from the combined condition to transfer task III, aphasic children as a group evidenced a mean per cent loss of 26.2 and in going from the combined modalities condition to transfer task IV, aphasic children as a group evidenced a mean per cent gain of 7.8. All of these differences were not statistically significant at the .05 level of confidence.

Discussion

Auditory Performance: For the aphasic group as a whole, improvement in auditory discrimination performance was found to be non-significant at the .05 level of confidence. None of the children demonstrated an ability to improve in discrimination ability over tasks.

Visual Performance: For the aphasic group as a whole, improvement in visual discrimination performance was found to be non-significant at the .05 level of confidence. However, three out of four children succeeded in learning the discrimination when the number of trials was increased to three hundred (300). The mean per cent improvement between tasks 1 and 2 and between tasks 2 and 3 was sixteen per cent (16%) and twelve point seventy-five per cent (12.75%) respectively. Though not significant at the .05 level, these gains were found to be significant beyond the .10 level of confidence. These results suggest that positive transfer does occur across successive visual tasks. This trend was not present with auditory tasks.

Combined Modalities Performance: For the aphasic group as a whole, improvement in combined modalities discrimination performance was found to be non-significant at the .05 level of confidence. Only slight improvement was found from task 2 to task 3 (mean percentage gain of 6.9%). Two out of eight children succeeded in learning the combined modalities discrimination when given a sufficient number of trials (300). These results suggest that some positive transfer may occur across successive combined modalities tasks. The trend, however, was not as great as with the visual tasks.

Unimodal vs. Combined Modalities Performance: For the aphasic group as a whole, differences between unimodal and combined modalities discrimination performance were found to be non-significant at the .05 level of confidence. However, certain trends were observed from the group data:

1. Prior auditory discrimination experience does not appear to affect subsequent combined modalities discrimination performance.

2. Prior combined modalities discrimination experience does not appear to affect subsequent auditory discrimination performance.

3. Prior visual discrimination experience appears to facilitate subsequent combined modalities discrimination performance.

4. Prior combined modalities discrimination experience appears to facilitate subsequent visual discrimination performance.

Summary of Findings

Within the limits of the present study it is suggested that, given one hundred (100) trials on each of three days, aphasic children:

1. Are not capable of improving their auditory discrimination performance.

2. Show evidence of an ability to improve their visual discrimination performance.

3. Show slight evidence of an ability to improve their combined modalities discrimination performance.

4. Show discrimination performance which is maximized in the combined modalities as compared with the unimodalities.

As for the normal children, most of their mean scores were so high that the absolute amount of improvement must, perforce, be small (the ceiling effect). Because of the great discrepancy between the aphasic children's discrimination performance scores and the "ceiling-high" scores of the normal children, the normal children were not considered to have constituted an effective control group for the present study.

Conclusions, Implications

It appears that aphasic children are attending to the visual stimuli in a more consistent manner than they are attending to the auditory stimuli. The improvement in combined modalities discrimination over visual discrimination may be due to the "alerting effect" of the auditory stimulus, which may serve to call the child's attention to the visual display before him. With the presentation of the visual stimulus alone, it is possible that the child is too distracted by his surroundings to attend consistently to the display. It is also possible that the auditory signal alone represents too "complex" a message for the aphasic child to assimilate and/or discriminate.

In terms of training aphasic children, the investigation may have important implications. Since the visual performance was superior to auditory, and greatest improvement was shown from task to task in the visual modality condition, it may be advisable to initiate the training by unimodal stimulation. The results of the present study suggest that overall performance is maximized with combined modalities presentation, and that combined presentation appears to be facilitated by prior visual presentations.

PROJECT III

AN INVESTIGATION OF AUDITORY SEQUENCING ABILITY

Background

As soon as the data were collected for the first project, the equipment was redesigned and modified. This report will detail some of the pilot studies which were done and describe the present investigation.

The ability to apprehend a sequence of events generated in time is a skill presumed to be related to the acquisition and use of language. The morpho-phonemic units which constitute spoken language are stimuli which are presented in a specific order and must be reproduced in that order to be understood. Individual sounds assume meaning only in relationship to those which precede and follow them, and the order of words in a sentence determines the meaning of the sentence. Monsees (1961) has suggested that sequencing difficulties are the core of the aphasic disability. Myklebust (1965) proposes that the inability to sequentialize auditorially results in writing disorders as well. The child is unable to hold syllables in mind long enough to reproduce them accurately on paper. Lowe and Campbell (1965) found that eight (8) aphasoid children had more difficulty with tasks involving judgments of succession and order than their normal controls. At the Institute for Childhood Aphasia, aphasic children performed significantly below age level expectation on standardized tests of sequencing ability (Stark, in press).

One of the difficulties encountered with the aphasic child is his tendency to reject the type of auditory-vocal interaction which is required in sequencing tasks such as digit span. Because he has to repeat what he hears and there are no visual cues, he may often become tense and reject the task. Hence, the use of operant conditioning techniques and automated equipment can be effective. It provides reinforcement for correct responses and eliminates "judgment" by a speaking human. The major objectives of this investigation are to determine the nature of the auditory sequencing abilities in an environment designed to elicit optimal performance, and to explore ways in which the sequencing ability can be improved.

Pilot Study

The experimental room included a table at which S was seated. On its horizontal surface, plexiglass screen was inset. At the far edge, a board was mounted several degrees from the vertical so that it sloped toward S. Through this board two plungers projected. Midway between the plungers there was an aperture through which rewards (e.g., trinkets and candy) were delivered. Behind the board was a feeder (Gerbrands, Model 70) consisting of buckets mounted on a continuous belt. Rewards placed in the buckets were expelled as the belt turned. Mounted on the board, above S's head level, was a 12" by 20" speaker cabinet (Utah, Model SM4). Below and behind the table there was a slide projector (Kodak Carousel 800) which, through a mirror arrangement under the table, projected visual stimuli onto the plexiglass screen. The slides were made so that each visual presentation consisted of one object (or series of objects) on the left half and another object (or series of objects) on the right half of the screen.

In an adjoining control room there was a tape player (Magnecordette Stereo, Series 100) and commercially available relay programming equipment. The function of this equipment was to automatically present visual and auditory stimuli, deliver rewards when appropriate, and record S's responses.

Nine items were chosen on the basis of the following criteria:

1. Easily picturable.

2. One-syllable words.

3. Commonly used count nouns (all on the Thorndike-Lorge list).

4. Different vowel sound in each word. The words selected were:

   tree, shoe, car, bird, fish, book, bed, cup, and hat.

There were three experimental conditions as follows:

1. Successive Auditory: The child heard a sequence auditorily ("shoe" - "car" - "hat"). Immediately thereafter, a pictorial representation of the correct sequence and one other containing the same items in a different order was projected on the table top. ("shoe" - "car" - "hat" vs. "car" - "shoe" - "hat") The child selected the sequence he believed to be the one he heard and pushed the lever over the picture he selected. He was rewarded for a correct choice by a feeder mechanism which dispensed a trinket, or a candy.

The sequence of items were randomized and began with a discrimination between sequences of two items ("shoe" - "hat" vs. "hat" - "shoe") and proceeded to more difficult discriminations, such as "hat" - "shoe" - "tree" - "car"-"bird" vs. "shoe" - "hat" - "tree" - "car" - "bird" (see Appendix B).

2. Simultaneous Auditory: This condition was similar to the latter except that the pictorial representation of the correct sequence was seen as the child heard the words.

3. Successive Visual: In this condition, the child saw a sequence which was projected visually for five seconds. Then another slide projected the correct and incorrect sequence and the child had to select by pushing the lever over the correct sequence.

Initially, six (6) children from the experimental population were given fifty-eight (58) trials in each of the three conditions cited. With the exception of one child, their scores were inconsistent and low. While it was felt that a response mode which allowed the child to push a lever rather than to repeat words would result in improved performance, it was obvious that the visual discrimination required was much too difficult. A number of changes were attempted in the response topography to determine whether this resulted in an improved performance. The experimental training for one of these children is detailed below.

M.T. (Boy, C.A. 7-6)

This seven and a half year old boy earned a language age score of 2-9 on the auditory vocal sequencing subtest of the ITPA. He was tested in all of the experimental conditions. Table IV presents summary data for his performance in thirteen (13) sessions. During the early sessions, M.T. was unsuccessful in discriminating a sequence of five items, as well as a sequence of two items. By pressing one of the two levers, he was able to designate which sequence he heard. In spite of an occasional block of trials in which there was an unusually high per cent of correct responses, it was obvious to the experimenters that he was functioning at a level which was no better than chance. One of the difficulties seemed to be his tendency to "read" the items in right to left order rather than left to right. However, even after some training was instituted by having him point to the items in a left to right order, his performance did not improve. (Sessions 4-7).

The visual discrimination required was ostensibly affecting his performance and a new procedure was implemented. M.T. was shown a slide with five items ("shoe" - "tree" - "car" - "book" - "hat"),

TABLE IV

SUMMARY DATA FOR M.T. IN SEQUENCING PILOT STUDIES

Session	Experimental Condition	Response Mode	Number of Stimulus Items *			
			2	3	4	5
1	Successive Visual	Lever Press	60	40	40	50
2	Simultaneous Auditory	Lever Press	30	30	70	40
3	Successive Auditory	Lever Press	40	50	60	70
4	Simultaneous Auditory	Lever Press	40	50	50	90
5	Successive Auditory	Lever Press	40	30	70	70
6	Successive Visual	Lever Press	40	40	70	30
7	Successive Auditory	Lever Press	90	40	30	20
8	Simultaneous Auditory	Pointing	100	40	-	-
9	Simultaneous Auditory	Pointing	80	30	-	-
10	Simultaneous Auditory	Pointing	90	60	-	-
11	Simultaneous Auditory	Pointing	100	50	-	-
12	Simultaneous Auditory	Pointing	80	30	-	-
13	Simultaneous Auditory	Pointing	100	65	-	-

*The entries are percent correct scores for blocks of ten trials except for sessions 9-13. In these sessions the number of trials for 3 stimulus items were respectively 60, 60, 40, 60 and 80.

however the experimenter presented one, two, or three items of the five to which he had to point. He was successful in pointing to two of five items in correct order, but did poorly with three of five items

A further modification was made in order to reduce the visual stimulus field from which M.T. had to select the items. Only three pictures were projected from which M.T. would select two for the first block of trials and then designate three by pointing to each in the order in which they were heard. While his performance still suggested that he had difficulty in manipulating sequences of three stimulus items, improvement from the previous response topography was evident. In examining Table IV, it should be noted that for the lever pressing trials, fifty per cent (50%) correct response was a chance performance, whereas for the pointing response, there is less than a four per cent (4%) chance of selecting a correct sequence of three out of three items. This procedure appeared one which could be used to study sequencing ability and was the basis for the on-going investigation which follows.

Procedure

During the first session, training was implemented to familiarize each child with the experimental apparatus. The stimulus items were those used during the pilot studies. Each child was shown a slide with two pictures and at first required to select one of the two (20 trials). This insured an understanding of the stimulus items. Then he was required to designate two out of two (10 trials) and then three out of three (10 trials). The items were presented auditorily at one per second. If the child touched the wrong item, the incorrect response automatically caused the apparatus to advance to the next series of stimuli.

Each child was seen for four additional experimental sessions. Four blocks of ten trials were presented in the following manner:

Block 1: Each child received ten (10) trials in which he had to select a sequence of two out of two items. Each experimental session started with the selection of two out of two in order to provide a high degree of success at the outset.

Block 2: The next ten trials were similar to the last ten of the training sequence. Each child was required to select three out of three items. The stimulus items were presented at one per second.

Block 3: Four different experimental conditions were used:

a. increased intensity on the first stimulus item;
b. increased intensity on the second stimulus item;
c. increased intensity on the third stimulus item;
d. intoning the stimulus items so as to minimize inflectional changes.

Block 4: The last ten trials will consist of the presentation of three out of three at one per second.

The stimulus items are presented in Appendix B. Blocks 2 and 4 are referred to as MONO. Block 3 (a), (b), (c) and (d) are referred to as EXP. A, EXP. B, EXP. C and EXP. D respectively.

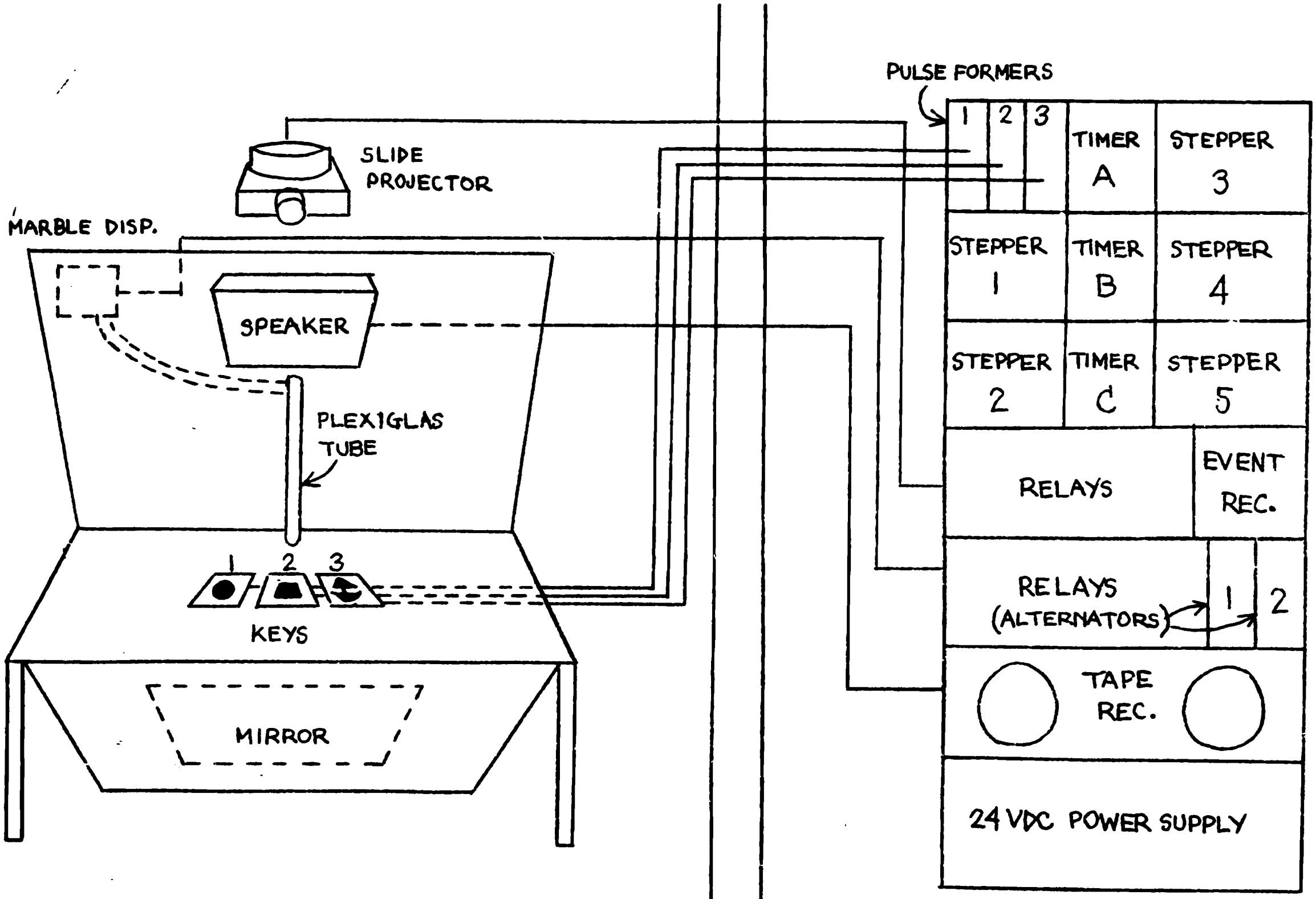
Apparatus

In the experimental room, the table at which S is seated is similar to the one described in the pilot study. However, on the horizontal surface, three frosted plexiglass response keys are mounted. The speaker is mounted on the vertical board above S's head (see Figure 3, attached). Below the speaker is a removable clear plexiglass tube, into which marbles are dropped. Behind the board is a marble dispenser which delivers the marbles from a reservoir. The slide projector mounted below and behind the table projects figures onto the response keys.

In the control room there is a tape recorder and commercially available relay programming equipment. The function of this equipment is to automatically present visual and auditory stimuli, deliver rewards when appropriate, and record S's responses. It operates as follows:

Visual stimuli are projected on the keys (e.g., a ball, a box and a boat, as in Figure 3) together with an auditory stimulus from the tape recorder through the speaker (e.g., "Box!" "Boat!"). The tape recorder is operated for the time necessary to present the auditory stimulus and then is shut off by Timer B. S must then depress the keys in the order in which the projected stimuli were named. The sequence in which the keys are to be depressed is programmed by the position of the steppers on that particular trial. In our example, the keys are to be depressed in the order 2 - 3 - 1. Depression of a key closes a microswitch which operates the appropriate pulse former. The pulse former shapes the microswitch output to a momentary electrical impulse and feeds this information through the steppers into a "decision matrix", made up of relays and alternators. The decision matrix matches the input with the program; i.e., was key two hit first, key three second, and key one last? If so, the marble dispenser is operated and a marble drops into the tube, the slide projector is operated, the keys go blank, and the

Figure 3 - Experimental Layout For Sequencing Study



inter-trial-interval clock (Timer A) is started. At the end of the inter-trial-interval the steppers are stepped to a new position, Timer B and the tape recorder are operated, and the slide projector displays the next visual stimulus pattern. If a key is responded to out of its programmed sequence the above events occur with the exception of the operation of the marble dispenser. If the response sequence is not completed within 30 sec., Timer C operates and the next trial begins. The event recorder marks on a moving paper chart which keys were hit and whether the order was correct for each trial.

In addition to an examination of the performance of the children on the auditory-vocal sequencing subtest of the ITPA immediately preceding and following his participation in this study, it is expected that some of the following questions may be explored:

Do changes in the configuration of the auditory stimulus improve sequencing performance?

Will the child do better when one of three items is more intense?

Will he do better when the three items are presented with a minimum of inflectional variation?

Will the child's sequencing ability improve as a result of this training?

PROJECT III

DEVELOPMENT OF TEACHING PROGRAMS WHICH MAXIMIZE VISUAL STIMULI

Background

This is an ongoing project which has involved all of the clinical staff at the Institute. The objective has been to develop instructional materials which are consistent with the guidelines described in the Introduction.

The procedures are consistent with programming principles (Smith and Moore, 1962; Fry, 1963). For example, there is a gradual progression to establish a more complex repertoire and a gradual withdrawal of stimulus support (fading). The programs are generally multiple choice with two or three choices although sections of some present six (6) possible responses. The method of construction has been linear, although branches are sometimes written specifically for a given child when he has difficulty with a given frame. Changes in the program content are determined by the responses of the children.

The programs have been designed so that they can eventually be automated. At this point however, we are able to use slotboards and sorting boxes. The sorting box is a 9"x31"x2-1/4" wooden box with five removable partitions. This allows for from one to six compartments. Stimulus cards, in full view of the child are held at the back of each compartment by small metal brackets. The discriminative stimulus may be a picture, word, or sentence. The child must place the card into the correct box (e.g., match the word to the picture).

The programs we have developed have been used successfully with the children at the Institute. A more detailed report of the development and evaluation of the form program by Robert Gottsleben is described in Appendix A.

Rationale

There remains much more which needs to be known about the acquisition and use of language. While psychologists tend to emphasize the environmental conditions which precipitate language responses (Staats and Staats, 1963), linguists continue to study the rules of the code itself (Bellugi and Brown, 1964).

The children in this project have not emerged from a language background which involved an identifiable set of levels beginning with one and two word constructions and proceeding to simple active-declarative "kernel" sentences. Their phonological, semantic, and syntactic development has been atypical from the outset. Menyuk (1964) has provided evidence which demonstrates that even children who have "functional" articulatory deviations manifest a syntactic structure which is different in kind from that of the child with normal speech.

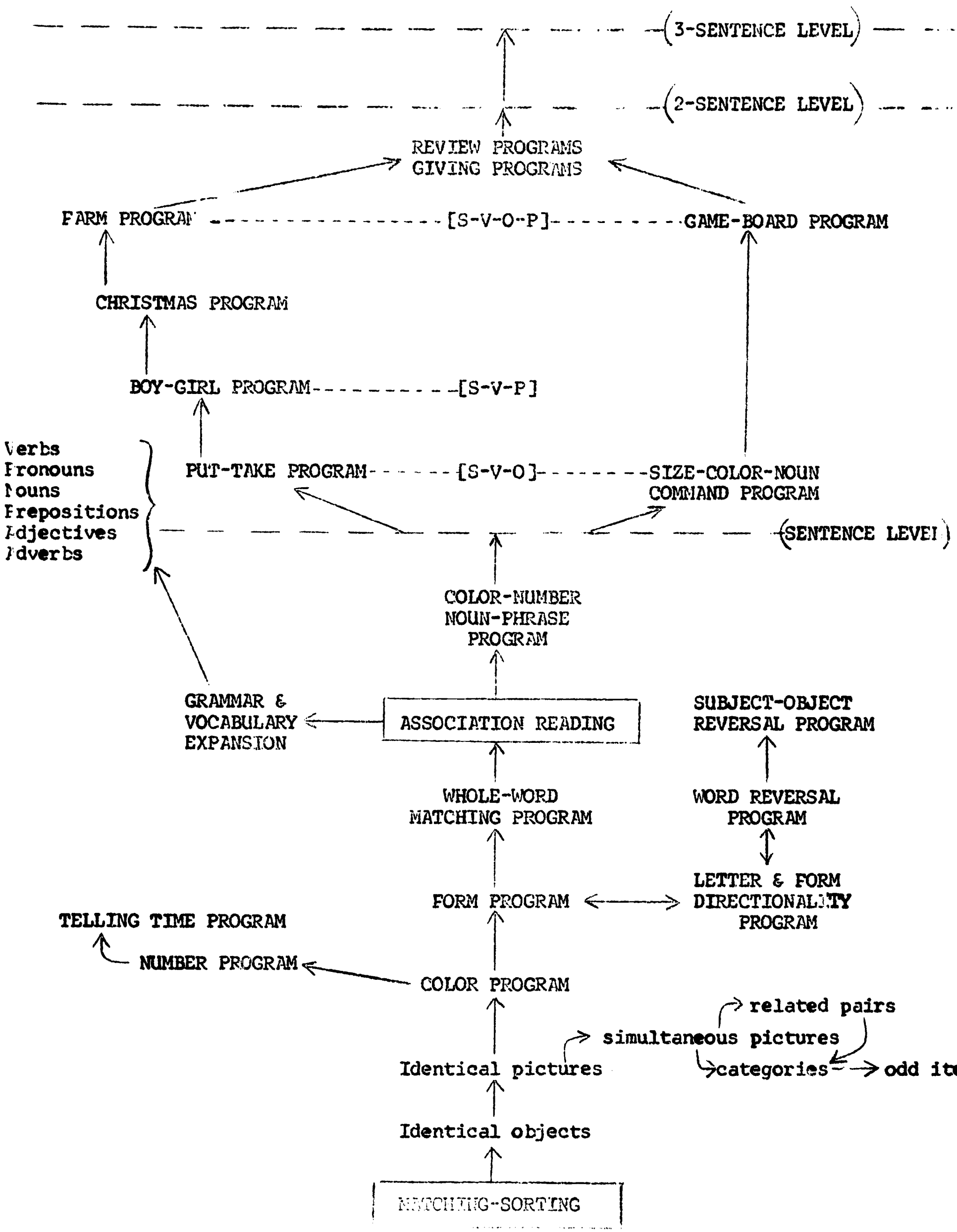
We can speculate about the difficulty that these children have in organizing incoming stimuli and attribute their problems to deficient "storage mechanisms", "reverberatory circuitry", and "activating systems". The manifestations, however, are difficulties in auditory and visual perception which results in a failure to develop and use language appropriately.

Because of the perceptual aberration, some attention must be given to skills which are "pre-verbal". Hence, we have developed some programmed materials which deal directly with the child's inability to distinguish left from right or provide experiences in the matching and sorting of objects, pictures, and forms. The evidence presented in the first project, as well as examination of the psycho-diagnostic profiles of these children, emphasizes the relative strength that they have in the visual modality. While we are developing programs which are primarily auditory, the materials included in this report make maximal use of visual stimuli. Figure 4 (attached) demonstrates the hierarchy of skills on which the development of these programs is based. Appendix contains the procedures for some of these programs.

While it is not possible to expect that training for the aphasic child can retrace the sequence of experiences which constitute normal language development, the teaching of words and sentences does consider the hierarchies involved. At first, the child learns to associate whole words to pictures (usually common count nouns, such as "ball", "hat", "tree", etc.) then early constructions involve "pivot" and "open" classes, with the "pivot" remaining constant.

The programs attempt to provide a phrase structure for these children. McNeill (1966) describes the capacity for language acquisition and demonstrates the significance of the phrase structure level at least before transformations begin to emerge. Chomsky (1957) calls the simple active declarative sentences terminal strings and indicates that they form the basis for all other sentences. Hence, the language programs are organized so as to provide the child with a sense of order and to teach him the major constituents of a sentence. While the stimuli in these programs are visual, the child is learning that

Figure 4 - Hierarchy of Tasks in Visual Programs



language has an order, and that parts of a sentence can be interchanged so that they will have different meanings. For example, in the "Christmas Program" which is described in Appendix C, the first items which the child learns to match (single word card to a single picture card) are noun phrases (article plus noun). The preposition is added to the noun phrase and the present progressive verb is taught, In presentation, the first noun phrase as well as the verb is constant and only the last item in the sentence varies. Similarly, once the child is able to manipulate np plus vp (v + np), a prepositional phrase is added. The final step has a structure which is article plus noun plus auxiliary plus verb plus article plus noun plus preposition plus article plus noun.

The children then are provided with units which are consistent with normal designative sentences. They learn to appreciate and understand that in using language, they must combine words in a particular order. Hopefully, this establishment of the basic grammatical relations leads them to comprehend and generate more complex language units.

Conclusion and Prospects

The project has enabled us to study the discrimination learning of aphasic children and develop programs which have been successful in teaching language to them. Our hope is that we can continue to develop and evaluate these materials. We would like to be able to automate some of these procedures and study them more carefully with a view toward a wider application for perceptually handicapped children with language difficulties.

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APPENDIX A

DEVELOPMENT AND EVALUATION OF THE FORM PROGRAM

(Prepared by Robert H. Gottsleben)

Background

The form program was developed to meet a need of the children at the Institute, many of whom had difficulty visually discriminating those letter forms used in beginning phonic reading training. Observations, made by those involved in teaching, indicated that a card matching and sorting task was an efficient teaching method for this task.

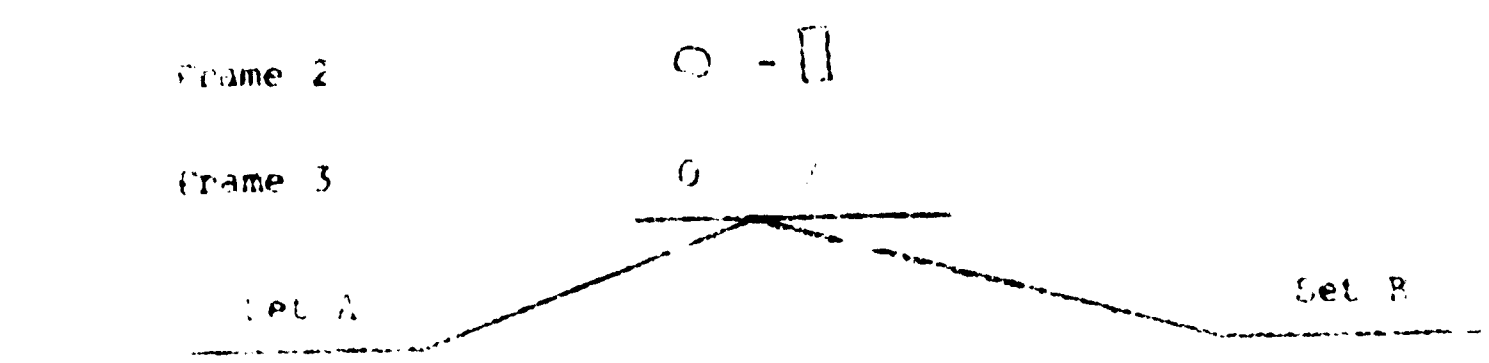
A trial form discrimination program of linear type was written, the beginning items of which were pictorial representations of a disc and a rectangular block. The disc and rectangle were chosen as they represented a continuation of an earlier program designed to teach discrimination of geometric objects. The second frame of the program showed the same pictures but in outline rather than solid drawing. The third frame reduced the rectangle to a straight line while the circle represents the letter "o". At this point the program was split into two branches, one for circular letters and one for straight-line letters. This split was written to provide graded frames which would teach discrimination of the most similar letters in this series.

Originally the program progressed from two forms to discriminate (the first two frames) to an upper limit of three forms (frames #3 through #9 on Set A, and frames #3 through #8 on Set B). However, at a later date, it was felt desirable to teach discrimination of each letter from every other letter, and since not all combinations of letters were included in the first 8-9 frames, three more frames were added to each set. The new frames add one letter per frame to the 3-letter discrimination task, so that with the final frame, all six letters in each set are presented as the discrimination task. The final frames of each set are the terminal behavior desired and also function as the pre- and post-tests.

The stimulus items were arranged in a sequence felt by the therapists to represent an ascending order of difficulty. One new letter was added with each new frame, while the letter which had been discriminated in the previous two frames was dropped (but added again in the final frames).

The form program, Sets A & B, as originally conceived, is as follows.

Stimulus Items



	Set A	Set B
Frame 4	i o m	o l b
Frame 5	o m s	l b t
Frame 6	m s e	b t k
Frame 7	s e a	t k f
Frame 8	e a c	k f h
Frame 9	a c o	k f h t
Frame 10	a c o e	k f h t b
Frame 11	a c o e s	k f h t b l
Frame 12	a c o e s m	

Figure a.

The extra frame in Set A is accounted for by the insertion of frame #9. This was added to provide the child with additional experience on the "a c o" discrimination, which was felt to be one of the most difficult in Set A.

Validation Study

To test the sequence of difficulty in the frames of each set, a validation project was set up. All children at the Institute for whom the program was appropriate were given the pre-test (see validation procedure attached). Additional testing thus far has included two pre-school deaf children and eleven mentally retarded children. The chronological age range of the children was from 3-0 to 9-2 with the majority being between 4-0 and 6-0.

The following chart (Figure a) indicates the actual number of tests and programs administered to date.

	Set A	Set B	Combined Sets A & B
Pre-tests	25	21	46
Teaching Program	4	5	9
Post-tests	1	4	5
Interim Tests	0	1	1

Figure b.

Number of Pre-tests:

% Correct	Set A	Set B	Combined Sets A & B
100	10	11	21
97	4	-	4
93	2	-	2
87	1	2	3
80	1	3	4
77	1	1	2
73	1	-	1
67	1	-	1
37	2	-	2
33	-	1	1
23	1	-	1
20	1	-	1
17	2	-	2
10	1	-	1
Totals	28	18	46

Figure c.

Of the forty-six pre-tests given (see Figure c) twelve, or twenty-six per cent (26%), were scored at 77% correct or less. The majority of errors in the lower brackets appeared to be the result of negativism and inattention. In some cases it is doubtful that the child understood the task as all cards were put into the middle boxes which were nearest to where the child sat.

Of the forty-six pre-tests given twenty-nine, or sixty-three per cent (63%), were scored at 93% correct or above, indicating too low a ceiling for this group of children.

To date only nine pre-tests indicated need for the teaching program to be given. Following administration of the teaching program, only five cases were available for post-testing. Analysis of pre-test and post-test errors on these five cases (one for Set A and four for Set B) is presented in Figures d and e below.

SET A

Stimulus Item	Pre-Test Errors	Post-Test Errors
a	1 (sorted into the [o] box)	None
c	4 (sorted into the [o] box)	1 (sorted into the [o] box)
o	1 (sorted into the [c] box)	None

(N=1)

Figure d.

Confusion of [a], [c], and [o] letters was indicated; all other letters being sorted correctly. Frame #9, Set A of the teaching program which specifically deals with [a], [c], and [o] discrimination was then presented and successfully completed by the child. The post-test indicated 97% correct (1 error). Interim test results were unable to be obtained for this child.

SET B

Stimulus Item	Pre-Test Errors	Post-Test Errors
k	2 (sorted into the [h] box)	1 (sorted into the [h] box)
f	5 (sorted into the [t] box)	2 (sorted into the [t] box)
h	5 (sorted into the [b] box)	2 (sorted into the [b] box)
t	6 (sorted into the [f] box)	2 (sorted into the [f] box)
b	2 (sorted into [h] & [k] boxes)	None
l	None	None

(N=4)

Figure e.

Analysis of individual pre-tests in Set B indicated h/b and t/f confusions. Teaching frames 5, 7, 8, and 9 of Set B were presented. Post-testing indicated seven errors (as against 20 pre-test errors) involving h/b and t/f.

Although a limited number of tests were given to date, the findings suggest that the teaching sequence for Set B should provide greater emphasis on h/b and t/f discriminations. The revised sequence for Set B is attached.

FORM PROGRAM
(Set A & B)

Goals

1. To train visual discrimination of specific letters

   Set A: circular letters
   Set B: straight-line letters

2. To train visual discrimination of an increasing number of stimuli (from two to six letters).

Pre-Requisites

Ability to demonstrate discrimination of simple geometric forms (pictured).

Materials

Both tests and teaching program use a 6-slot sorting box with stimulus card brackets.

A. Tests:

   1) 6 stimulus cards (3"x5") for each set:
      Set A: a, c, o, e, s, m (1-1/2" - 2" letters, black)
      Set B: t, f, k, h, b, l " " " "

   2) Thirty response cards for each set (3"x5"); these are random assortments of the six letters (5 each) in each set.

B. Teaching Program:

   1) 3"x5" stimulus cards, the number and letter of which are determined by the frame being taught (see dittoed teaching program attached).

   2) 3"x5" response cards, five of each for every stimulus card, printed with letters identical to the stimulus cards.

FORM PROGRAM (Continued)

Procedure

A. Pre- and Post-Testing:

1) Sorting box is placed directly in front of subject

2) Teacher places stimulus cards in brackets working left to right in the following sequences:

Set A: a, c, o, e, s, m
Set B: t, f, k, h, b, l

3) Teacher hands subject one response card at a time

4) Subject matches response card to stimulus card by placing response card in the correct box

5) Teacher removes first response card and hands subject second response card, etc.

6) Errors are noted but the subject is not informed as to the correctness of his responses (this is testing - not teaching)

7) The first post-test should be administered immediately upon completion of the teaching program. A second post-test should be given after a delay of several days, or weeks, to check retention.

B. Teaching Program:

1) Analyze pre-testing errors. Begin teaching program at the point at which the subject's error responses first appear (e.g., an s-m confusion as shown on the pre-test would begin with frame #4)

2) Stimulus cards (determined by the frame being presented) are placed in brackets in left to right order

3) The subject is handed response cards, previously randomized, one at a time

4) The previous response card is removed from the sorting box before the next response card is given to the subject

5) If errors occur, the response card is removed from the incorrect slot and returned to the child

FORM PROGRAM (Continued)

B. Teaching Program (Cont.):

6) For those children who have difficulty at some specific point in the teaching program, a wash back loop (return to an earlier portion of the program), or remedial loop (individualized teaching which removes the child from the program proper, but on completion of this special teaching loop, returns the child to that frame of the program with which he had difficulty originally) is given

Appendix B

Stimulus Items Used in Sequencing-Pilot Study

1. bird - cup
2. bed - cup
3. book - fish
4. shoe - cup
5. car - bird
6. car - shoe
7. hat - car
8. bird - hat
9. cup - hat
10. shoe - tree
11. cup - tree - book
12. bird - car - book
13. shoe - car - book
14. book - bed - fish
15. shoe - cup - tree
16. fish - bird - cup
17. shoe - hat - bed
18. fish - cup - hat
19. bird - shoe - tree
20. shoe - tree - car
21. fish - hat - cup - shoe
22. cup - book - fish - bed
23. car - bed - book - fish
24. tree - hat - car - fish
25. bird - hat - shoe - book
26. shoe - car - bed - bird
27. bed - cup - fish - bird
28. car - tree - book - cup
29. bird - book - hat - tree
30. tree - shoe - car - fish
31. book - tree - car - bird - hat
32. fish - hat - bed - bird - cup
33. shoe - tree - book - car - fish
34. bed - tree - book - hat - cup
35. shoe - tree - hat - cup - book
36. car - hat - bird - book - bed
37. shoe - cup - tree - fish - bed
38. car - cup - tree - bed - shoe
39. car - bed - cup - hat - tree
40. fish - tree - bed - book - bird

Appendix B

Stimulus Items in Children's Sorting Study

1 out of 2

1. Cup - Bird
2. Bed - Cup
3. Book - Fish
4. Shoe - Cup
5. Car - Bird
6. Car - Shoe
7. Hat - Car
8. Bird - Hat
9. Cup - Hat
10. Shoe - Tree
11. Shoe - Tree
12. Cup - Hat
13. Bird - Hat
14. Hat - Car
15. Car - Shoe
16. Car - Bird
17. Shoe - Cup
18. Book - Fish
19. Bed - Cup
20. Cup - Bird

2 out of 2

1. Cup - Bird
2. Cup - Bed
3. Fish - Book
4. Cup - Shoe
5. Bird - Car
6. Car - Shoe
7. Hat - Car
8. Bird - Hat
9. Hat - Cup
10. Tree - Shoe

MONO I

1. Book - Cup - Tree
2. Book - Car - Bird
3. Car - Book - Shoe
4. Bed - Fish - Book
5. Shoe - Tree - Cup
6. Bird - Cup - Fish
7. Shoe - Hat - Bed
8. Cup - Fish - Hat
9. Shoe - Tree - Bird
10. Car - Shoe - Tree

EXP I, B, C, D

1. Tree - Car - Shoe
2. Bird - Shoe - Tree
3. Fish - Hat - Cup
4. Shoe - Bed - Hat
5. Cup - Bird - Fish
6. Cup - Tree - Shoe
7. Bed - Fish - Book
8. Book - Car - Shoe
9. Bird - Book - Car
10. Tree - Book - Cup

MONO II

1. Cup - Tree - Book
2. Book - Bird - Car
3. Car - Shoe - Book
4. Book - Fish - Bed
5. Cup - Shoe - Tree
6. Cup - Bird - Fish
7. Shoe - Bed - Hat
8. Cup - Fish - Hat
9. Tree - Bird - Shoe
10. Car - Tree - Shoe

APPENDIX B

PRESENT EQUIPMENT

Quantity	Item	
2	Pulse former	(G.S. E783F)
1	Pulse former	(G.S. E3620A)
1	Timer	(For. 1617)
2	Timer	(G.S. E4300)
2	Stepper	(For. 1185 M3)
1	Stepper	(For. 1482 M3)
1	Alternator	(G.S. E4590A)
2	8-Relay panel	(G.S. E783B)
1	8-Relay panel	(Self designed)
1	4-Relay panel	(Self designed)
1	2-Relay panel	(Self designed)
1	Counter	(G.S. E3700A)
1	20-Light panel	(Self designed)
1	5-Light panel	(Self designed)
1	Switch panel	(Self designed)
1	Power supply	(G.S. E783DA)
1	Pre-amplifier	(Self designed)
1	Tape recorder	(Magnecordette)
1	6-channel event recorder	(Esterline-Angus)
1	Slide projector	(Kodak 800)
1	Universal Feeder	(Gerbrands)
1	Marble dispenser	(Gerbrands)
1	Timer	(For. 1617)
1	Stepper	(For. 1488)
1	Speaker	(Utah-SH-4)

For. is Foringer
G.S. is Grason-Stadler

Appendix C

COLOR DISCRIMINATION PROGRAM

I. GOAL: To teach visual discrimination of blue and yellow.
To teach a sense of "yellowness" and "blueness".

II. PRE-REQUISITES:
A. Ability to recognize an object.
B. Ability to manipulate an object.
C. Ability to recognize a picture.
D. Ability to manipulate a 3x5 card.

III. MATERIALS: The materials used in this program are two large sorting boxes (blue and yellow) and a variety of blue and yellow objects. The objects used at the beginning of the program are simple one inch cubes and will change to a variety of geometric forms to add complexity to the forms used. Following the forms is the gradual shift to rectangular color chips leading into the use of 3x5 cards. The color patches on the 3x5 cards move into a series of solid then line drawings and finally to the actual word written in the color as the highest level of this program. The color word was used as the highest level as the program is geared to the teaching of reading.

Order of presentation: The order was chosen to use colored objects (with entire mass in the color) and gradually faded from the three dimensional to two, the use of a card entirely colored. The amount of color on the card is faded until the child is functioning with the printed word in its respective color.

PROCEDURE:

1. A blue box is placed in front of the child.
A blue block is placed in front of the blue box.
The teacher demonstrates placement of the blue block into the blue box.

2. Another blue block is placed in front of the blue box.
The teacher gestures to the child to place the blue block into the blue box.

3. Blue blocks are placed in front of the blue box and the child is to place each in the blue box.
5 correct placements is criteria.

Box and Blocks Remain

4. A yellow box is placed in front of the child. A yellow block is placed in front of the yellow box. The teacher demonstrates placement of the yellow block into the yellow box.

5. Another yellow block is placed in front of the yellow box. The teacher gestures to the child to place the yellow block into the yellow box.

6. Yellow blocks are placed in front of the yellow box and the child is to place each in the yellow box. 5 correct placements is criteria.

7. Both boxes with blocks are placed in front of the child and a random assortment of blue and yellow blocks are placed in between the two boxes. 10 correct placements is criteria.

8. A random assortment of blue and yellow blocks and additional geometric objects are placed in between the two boxes. 10 correct placements is criteria.

9. A random assortment of the following are placed in between the two boxes with 10 correct placements as criteria:

Geometric objects

Geometric objects and color chips

Color chips

Color chips and color patches

Color patches

Color patches and solid "things"

Solid "things"

Solid "things" and line "things"

Line "things"

Line "things" and vertical lines

Vertical lines

Vertical lines and color words

Color words

INSTITUTE FOR CHILDHOOD APHASIA

"PUT" PROGRAM

I Goal

A To teach the child to respond to written instructions.

B To develop a core vocabulary.

C To teach the grammatical structure of commands

II Materials

A 3"x5" index cards printed with Primer type words

B A red can, a blue can, a red box, a blue box

C Picture chips of a man, a lady, a cat, a dog

D A slot board

E Score sheet

IV Procedure:

A Present a can and a box, each labeled, and a deck of 10 cards typed with "can" and "box".
Take turns with the child selecting a card and placing it in its corresponding receptacle.
Remove the label from the can and continue sorting printed cards. Return the "can" label; remove "box" label and re-sort printed cards. After five correct responses from child for each of these conditions; remove both labels and sort printed cards once more.

Present a red can and a red box and a deck of cards labeled "red can", "red box". Proceed as in first step. Continue in this manner until reaching the level of four choices: red can, red box - blue can, blue box.
Repeat once more using the following labels:

in the red can, in the red box
in the blue can, in the blue box

B To teach the nouns, man, lady, cat, dog, place the picture chips in a slot board with a word card beneath each chip. Have the child select a word card and place it beneath the appropriate picture.

After all four pictures have been labeled, remove the word cards and begin this process again, this time leaving only three labels on the slot board as matching cues. Proceed similarly, removing one

additional word card each presentation until the child is placing the word cards beneath appropriate pictures with no additional cue.

To avoid having the child rely on positional cues, be sure to rearrange the placement of the picture chips at the beginning of each presentation.

C In the final step of the procedure, have the four picture chips displayed on the desk. Have the child select the two receptacles which may be designated as his for the sake of creating a competitive game.
Take turns choosing an instruction card from a deck containing a random assortment of possibilities. Follow the directions typed on the card until the deck is depleted. Count the number of picture chips in the receptacle to see who "won".

Order of Presentation

A can - box

B red can - red box

C blue can - blue box

D red can - blue can
red box - blue box

E in the red can
in the blue can
in the red box
in the blue box

F cat, dog, man, lady

G Put the cat in the red box
Put the dog in the blue box
Put the man in the red can
Put the lady in the blue can
Put the cat in the blue box
Put the dog in the red can
Put the man in the blue can
Put the lady in the red box
etc.

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CHRISTMAS PROGRAM

I. Goal:

A To have the child learn to match sentences with the following structure: noun, verb (constant), object, preposition, object of preposition to the appropriate pictures.

B

1) To have the child select appropriate pictures after hearing the sentences spoken.

2) For the deaf child - to be used as a lipreading prog a

C To have the child learn to read these aloud.

D To have the child learn to say these without the written clue.

Secondary Goals

A To increase noun and preposition vocabulary.

B To improve sequencing skills in all modalities.

C To provide practice in this grammatical structure.

II. Pre-requisites

A Visual Perception must be adequate for discrimination of pictured and typewritten materials.

B Left to right directionality should be established for correct scanning of printed material.

C Motor control for placing index cards.

D Child is familiar with card matching procedure from experience on earlier programs.

III. Materials

A 3"x5" index cards printed with pictures or typewritten words.

B A card holder

C Score sheet

IV. Procedure: Administered by hand
(The following steps apply to each level of the program)

A - Procedure for Goal A

1. General procedure:

Place the picture cards across the top row of the slotboard.
Hand the child word cards, one at a time for placement beneath the appropriate picture card.
Criterion for success is five consecutive correct matching responses for each picture card.

2. Specific procedure:

Begin with matching a single word card to a single picture card. Then present a choice of two picture cards with random presentations of the matching word cards. This procedure expands to include any number of items.

B - Procedure for Goal B

At the completion of Step A, add the following:

Ask the child for each card in turn, and have the child find and return them.

Either the word cards or the picture cards can be returned first.

Procedure for Goal C

Take turns with the child requesting cards from the board.

Procedure for Goal D

After completion of Step C, return picture cards only to board, and take turns with child requesting picture cards.

V. Order of Presentation

A. Santa Claus
The teacher

B. The ball
The toys
The books
The candy
The pictures
The clothes

C. The window
The tree
The door

D. On the door
On the tree
On the window

E. Next to the door
Next to the tree
Next to the window

F. Between the doors
Between the trees
Between the windows

G. Pre-test: Selected Assortment from Steps D, E & F

H. The teacher is hanging the bell
The teacher is hanging the clothes
The teacher is hanging the toys
The teacher is hanging the candy
The teacher is hanging the pictures
The teacher is hanging the books

I. Santa Claus is hanging the ball
Santa Claus is hanging the clothes
Santa Claus is hanging the toys
Santa Claus is hanging the candy
Santa Claus is hanging the pictures
Santa Claus is hanging the books

J. Presentation of a Selected Assortment from Steps H & I

K. <u>FINAL STEP</u>:

The teacher is hanging the clothes next to the tree
The teacher is hanging the books on the door
Santa Claus is hanging the picture on the window
Santa Claus is hanging the toy between the trees
The teacher is hanging the bell between the trees
Santa Claus is hanging the candy next to the tree

L. TEST (Pre-test and Post-test)

Selected Assortment of cards with the same structure as those in FINAL STEP.

INSTITUTE FOR CHILDHOOD APHASIA

Directionality Program

I. Goal

1) To teach the visual discrimination of 2-element letter forms, the variable element differing with regard to left, right, up and down position.

II. Prerequisites

1) Ability to match identical pictures given a choice of four.

2) Motor skill to manipulate program materials.

III. Materials

1) 3"x5" index cards printed with forms to be matched.

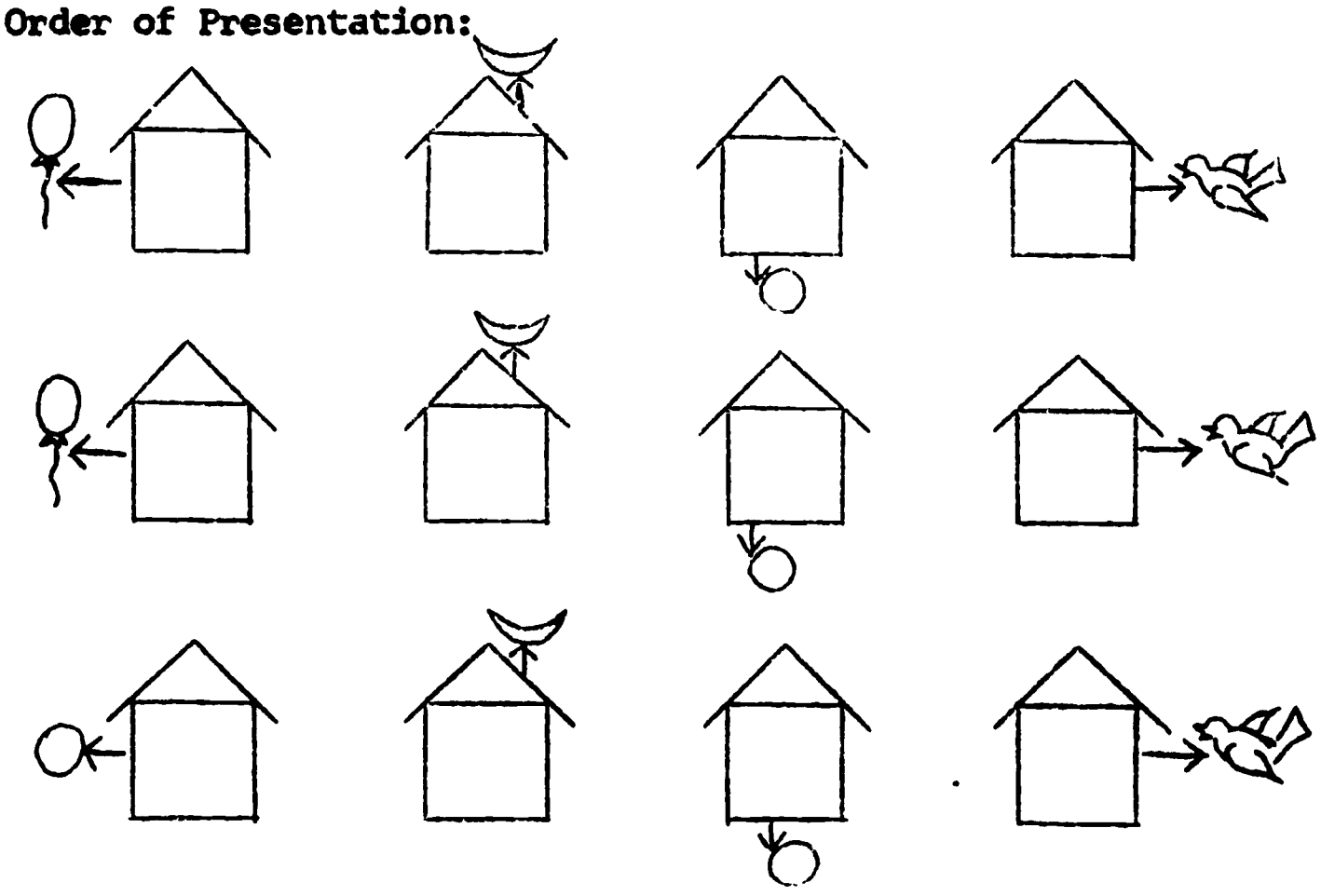
2) A card holder

3) A score sheet

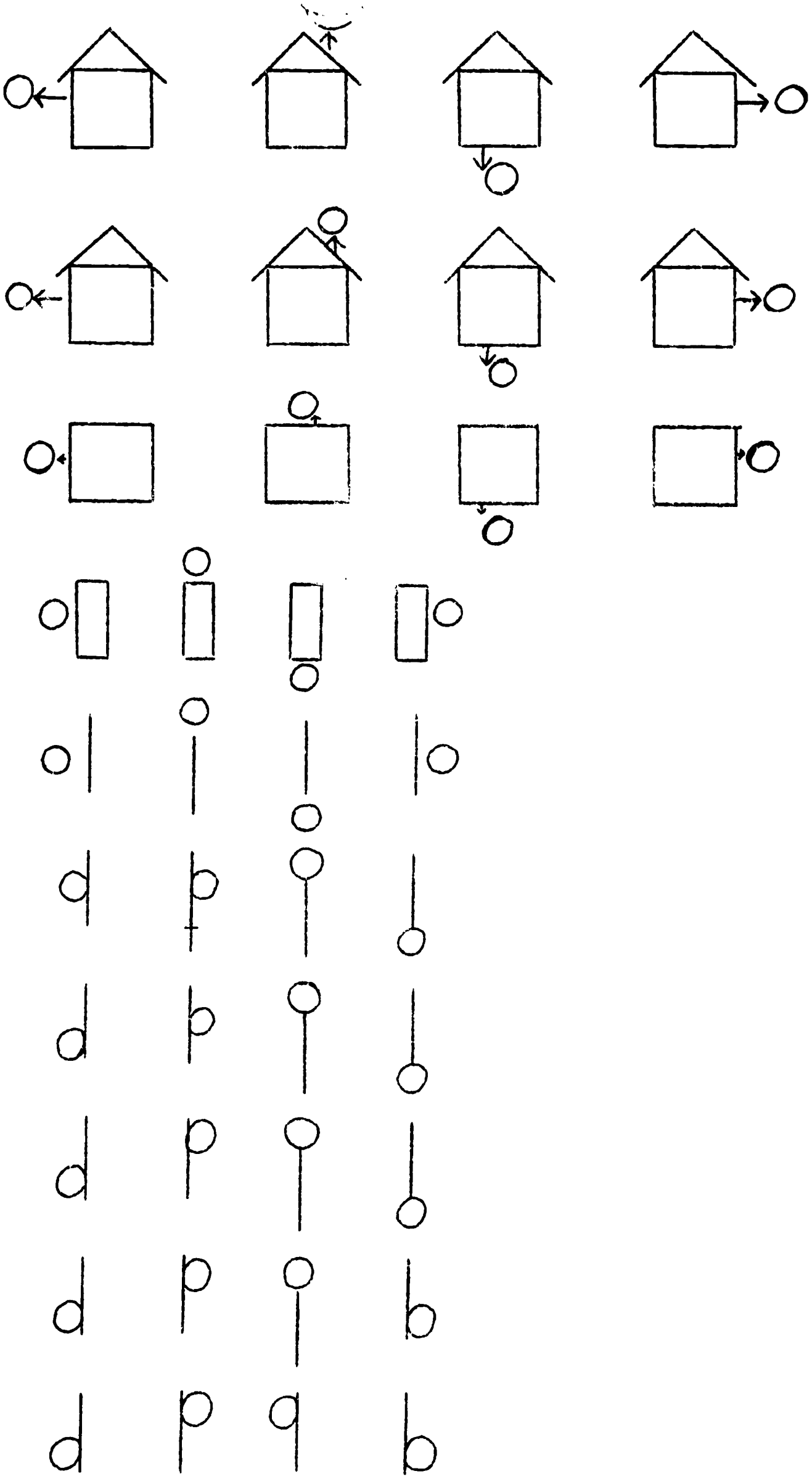
IV. Procedure

Place the four stimulus cards of the first level in a row on the slotboard. Hand child the four response cards one at a time. Child places response card on top of appropriate stimulus card. Remove response card before presenting child with next one. Clear board. Repeat this procedure for each of the thirteen levels, rotating the positions of the stimulus items at each level.

V. Order of Presentation:



Directionality Program (Cont.)



INSTITUTE FOR CHILDHOOD APHASIA

READING PROGRAM: NUMBER, COLOR, NOUN, PHRASE

I. Goals:

A To have the child learn to match written phrases containing a noun with a number and color adjective to the appropriate pictures.

B

1) To have the child select appropriate pictures after hearing the phrases spoken.

2) For the deaf child - to be used as a lipreading progr m

Secondary Goals:

A Learning printed color names for red, blue, green and yel o

B Learning Arabic numerals 1,2,3 as adjectives.

C Learning selected printed noun vocabulary.

D Training for independent work.

II. Pre-requisites

A Successful completion of the following ICA Primary Progra s or their equivalent:

1) Color
2) Form
3) Number
4) Whole word matching for Visual Perception

B Left to right directionality should be established for correct scanning of printed material.

C Motor control for placing index cards.

III. Materials

A Color chips and 3"x5" index cards printed with numerals, color patches, pictures or primer typewritten words.

B A card holder.

C Score sheet.

IV. Procedure

A. Procedure for teaching nouns:

1) General Procedure:

Place the picture cards across the top row of the slot boa
Hand the child word cards, one at a time for placement beneath the appropriate picture card.
Criterion for success is five consecutive correct matching responses for each picture card.

2) Specific Procedure:

Begin with matching a single word card to a single picture card. Then present a choice of two picture cards with random presentations of the matching word cards. This procedure expands to include any number of items.

B. Procedure for teaching number adjectives:

1) Replace noun pictures in slot board. Match printed cards with labels containing number adjective and noun. Do this for numeral 1.

2) Leave cards on board. Place pictures showing two of each item on board. Have child match cards with appropriate labels to these pictures.

3) Remove and shuffle the word cards. Have child replace cards matching to all six pictures.

4) Repeat matching process with pictures containing three of each item and number adjective three word cards. Remove cards.

5) Repeat process using picture cards and labels for number adjectives one, two and three.

C. Procedure for teaching colors:

1) Place the yellow and blue color chips on the slot board. Have the child place the following cards in a vertical row below the appropriate color chip:

a) color patch.
b) color-word printed in enlarged color keyed letters
c) color-word printed in enlarged black letters.
d) color-word typewritten.

Clear board except for color chips and repeat procedure omitting step (a) above. Proceed similarly omitting one additional step with each presentation until the child is matching the typewritten words to the color chips. Be sure to vary position of the color chips periodically.

2) Proceed as in step 1 using colors red and green.

3) Repeat procedure using three colors.

4) Repeat procedure using all four colors.

D. Procedure for teaching color-noun:

1) Place three noun pictures of a single color on the slot board. Review by having child place noun labels beneath them. Then place printed cards of color-adjective and noun labels beneath appropriate pictures. Leave on board.

2) Place picture cards of a second color on the slot board and place color-adjective noun labels beneath appropriate pictures. Remove labels and shuffle.

3) Have child replace word cards for all six picture cards. Clear board.

4) Repeat process using picture cards of third color and appropriate color-adjective noun labels. Leave on board.

5) Place picture cards of fourth color on slot board and place color-adjective noun labels beneath appropriate pictures. Remove labels and shuffle.

6) Have child replace word cards for all six picture cards. Clear board.

7) Put eight assorted picture cards illustrating all three nouns and four colors on slot board. Have child match appropriate labels.

E. Procedure for presenting Color, Number Nouns

1) Review by presenting noun cards of same color and quantity.
Have child label as follows (leaving them on board):

a. Noun cards
b. Number-adjective noun cards
c. Color-adjective noun cards
d. Number color-adjective noun cards

2) Remove. Place eight picture cards illustrating an assortment of two number and two color adjectives on board. Have child label these.

3) Remove cards. Place eight picture cards illustrating an assortment of three number and three color adjectives on the board. Have child label these.

4) Remove. Repeat procedure using an assortment of eight picture cards illustrating three number and four color adjectives with nouns.

V. Order of Presentation:

A. car
ball
tree

B. 1
2
3

C. 1 car
1 ball
1 tree

D. 2 cars
2 balls
2 trees

E. Combination of C & D

F. 3 cars
3 balls
3 trees

G. Combination of C, D & F

H. Color chips: yellow, blue
Color patches: yellow, blue
Color-keyed words: yellow, blue
Enlarged black words: yellow, blue
Typed words: yellow, blue

I. Color chips: red, green
Color patches: red, green
Color-keyed words: red, green
Enlarged black words: red, green
Typed words: red, green

J. Color chips: red, blue, yellow
Color patches: red, blue, yellow
Color-keyed words: red, blue, yellow
Enlarged black words: red, blue, yellow
Typed words: red, blue, yellow

K. Color chips: red, blue, green, yellow
Color patches: red, blue, green, yellow
Color-keyed words: red, blue, green, yellow
Enlarged black words: red, blue, green, yellow
Typed words: red, blue, green, yellow

L. Pictures: red car, red ball, red tree

Labels: car, ball, tree
red car, red ball, red tree

Reading Program (Cont.)

M. Pictures: blue ball blue tree blue car

Labels: blue ball blue tree blue car

N. Combination L & M above

O. Pictures: green ball green car green tree
yellow ball yellow car yellow tree

Labels: green ball green car green tree
yellow ball yellow car yellow tree

P. Pictures: red car blue ball red tree yellow car
green tree yellow car green ball blue tree

Labels: red car blue ball red tree yellow car
green tree yellow car green ball blue tree

Q. Pictures: 1 red car 1 red ball 1 red tree

Labels:

car	ball	tree
1 car	1 ball	1 tree
red car	red ball	red tree
1 red car	1 red ball	1 red tree

R. Pictures: 2 red trees 1 blue car 2 blue trees 1 red tree
1 blue ball 2 red balls 1 red car 2 blue balls

Labels: 2 red trees 1 blue car 2 blue trees 1 red tree
1 blue ball 2 red balls 1 red car 2 blue balls

S. Pictures: 1 blue ball 3 red trees 2 blue cars 1 blue tree
2 green cars 1 green ball 3 red balls 2 green balls

Labels: 1 blue ball 3 red trees 2 blue cars 1 blue tree
2 green cars 1 green ball 3 red balls 2 green balls

FINAL STEP

T. Pictures: 2 blue cars 1 green tree 3 blue balls 2 green cars
3 red balls 2 yellow cars 1 red tree 3 yellow balls

Labels: 2 blue cars 1 green tree 3 blue balls 2 green cars
3 red balls 2 yellow cars 1 red tree 3 yellow balls

U. TEST: Assortment similar to cards in FINAL STEP

V. Order of Presentation

A. boy
girl

the boy
the girl

B. sit
play

sits
plays

C. the boy sits
the boy plays

D. the girl sits
the girl plays

Check #1

E. the boy sits
the boy plays
the girl sits
the girl plays

F. on
under

G. on the bed
under the bed

H. on the chair
under the chair

I. on the table
under the table

J. under the chair
under the table
under the bed

K. on the bed
on the table
on the chair

Check #2

L. Steps J & K: combined

M. The boy sits on the bed
The boy sits under the chair
The boy plays on the table
The boy plays under the bed

BOY - GIRL Program (Cont.

N. The girl sits on the chair
The girl sits under the table
The girl plays under the chair
The girl plays on the bed

O. FINAL STEP

The boy plays on the bed
The boy plays under the chair
The boy sits on the table
The girl sits under the chair
The girl sits on the bed
The girl plays under the table

P. TEST

The boy sits on the bed
The boy sits under the chair
The boy plays under the table
The girl plays under the chair
The girl plays on the bed
The girl sits under the table

2

INSTITUTE FOR CHILDHOOD APHASIA

BOY - GIRL - BABY

A. boy
girl
baby

the boy
the girl
the baby

B. sit
play
lie

sits
plays
lies

C. the boy sits
the boy plays
the boy lies

D. the girl sits
the girl plays
the girl lies

E. the baby sits
the baby plays
the baby lies

Check #1

F. the boy sits)
the girl sits)
the baby lies)
the boy plays) Assortment of items from C, D & E
the girl lies)
the baby plays)

G. bed
table
chair

the bed
the table
the chair

H. on the chair
under the chair

I. on the bed
under the bed

J. on the table
under the table

Check #2 K. on the chair
under the chair
on the bed
under the bed
on the table
under the table

L. The boy lies on the chair
The boy lies under the chair
The boy plays on the chair
The boy plays under the chair
The boy sits on the chair
The boy sits under the chair

M. The girl lies on the bed
The girl lies under the bed
The girl plays on the bed
The girl plays under the bed
The girl sits on the bed
The girl sits under the bed

FINAL STEP

N. The baby lies on the table
The baby lies under the table
The baby plays on the table
The baby plays under the table
The baby sits on the table
The baby sits under the table

Pre-test & Post-test

O. The boy sits on the bed
The boy plays on the table
The boy lies under the chair
The girl sits on the chair
The girl lies on the bed
The girl plays under the table
The baby sits under the chair
The baby lies on the chair
The baby plays on the bed

INSTITUTE FOR CHILDHOOD APHASIA

FARM PROGRAM

V. Order of Presentation

A. The horse
The tractor
The farmer
The cowboy
The barn
The field

B. The cowboy is pulling
The cowboy is riding
The farmer is pulling
The farmer is riding

C. The cowboy is pulling the horse
The cowboy is pulling the tractor
The cowboy is riding the horse
The cowboy is riding the tractor

D. D. The farmer is pulling the horse
The farmer is pulling the tractor
The farmer is riding the horse
The farmer is riding the tractor

E. Presentation of a selected assortment from Steps C & D

F. Out of the barn
Out of the field
Into the barn
Into the field

FINAL STEP

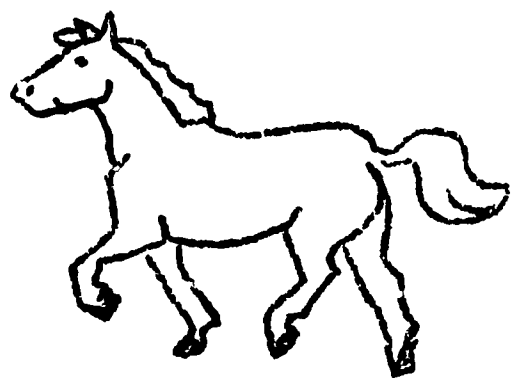
G. The cowboy is riding the horse out of the barn
The farmer is pulling the tractor into the field
The farmer is riding the horse into the barn
The cowboy is pulling the tractor out of the barn
The cowboy is riding the tractor out of the barn
The farmer is riding the tractor into the field

TEST (Pre-test & Post-test)

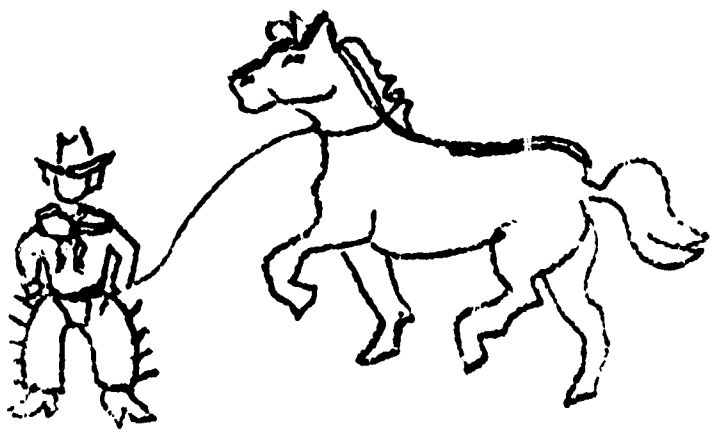
H. Selected assortment of cards similar to those in Step G

the barn

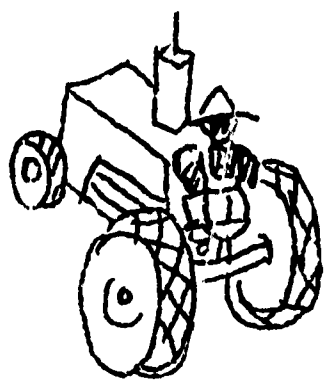
the field



the horse



The cowboy is pulli

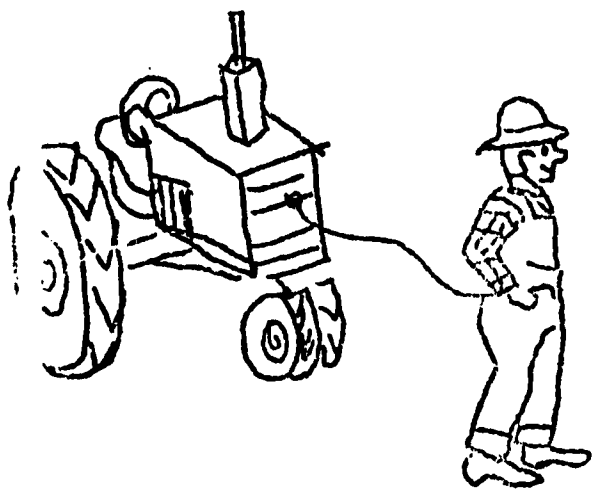


The farmer is ridi

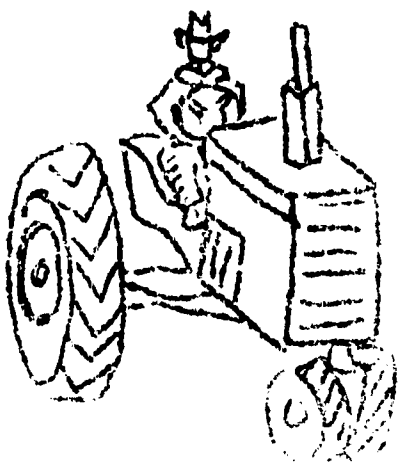
to the barn

out of the field

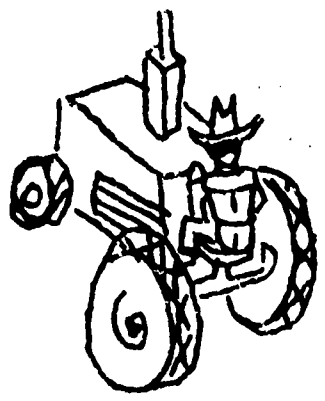
The cowboy is riding
the horse



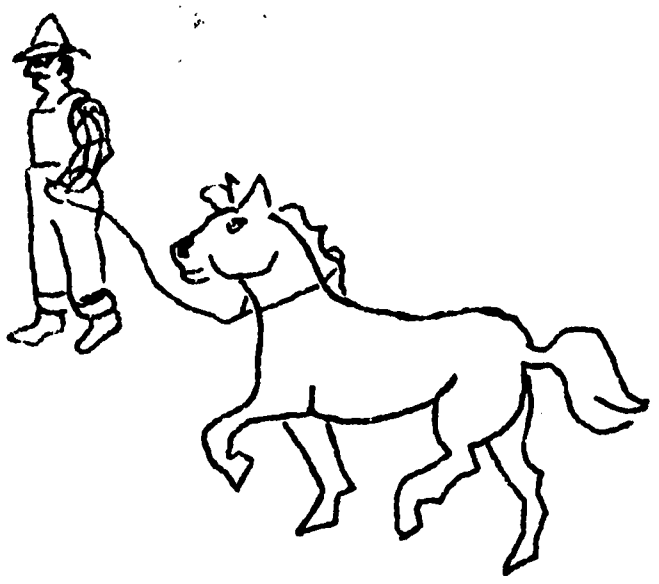
e farmer is pulling
e tractor



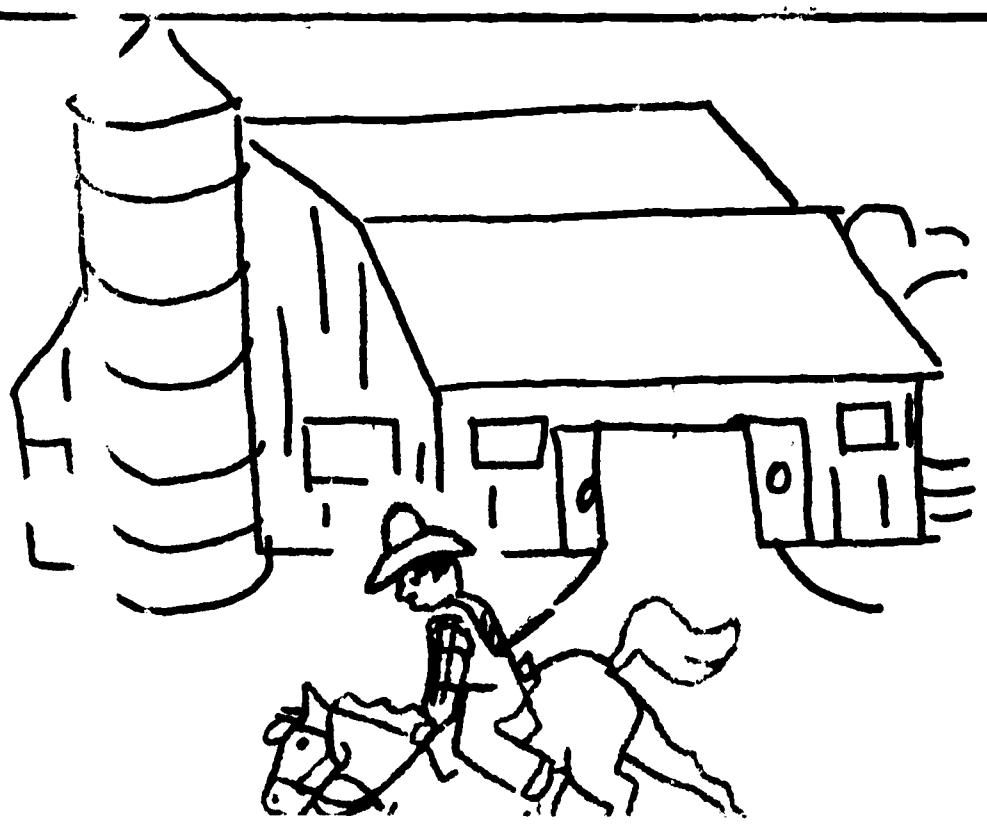
The cowboy is ridi
the tractor



The cowboy is riding
the tractor
into the barn.



The farmer is pulling
the horse
into the field.



The farmer is riding
the horse
out of the barn.

ICA

FORM B

Name: _____

READING PROGRAM

WORD A: _____ BD: _____ C.A. ___

WORD B: _____ Exmr: _____

Goal: To train picture to word matching of 2 words

Note: Position of stimulus items changes from frame to frame

Materials: Stimulus Items: 1 picture A, 1 picture B, 1 word A, 1 word B

Response Items: 5 picture A cards, 5 picture B cards (randomly arranged)

Program Date: _____

	Stimulus Items	Response Items	Trials
1.	pic B pic A word B word A	pic A pic B	word A: _____ word B: _____
2.	pic B word A word B	Same	
	pic A word B word A	Same	

Pre-Test Date: _____

Stimulus Items	Response Items	Trials
word A word B	pic A pic B	word A: _____ word B: _____

Post-Test Date: _____

Stimulus Items	Response Items	Trials
word A word B	pic A pic B	word A: _____ word B: _____

	Pre-Test	Post-Test
Total No. Correct		
Total % Correct		

ICA

READING PROGRAM

Goals: 1) To train word to picture matching of "boy" and "girl"

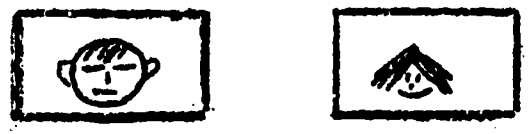
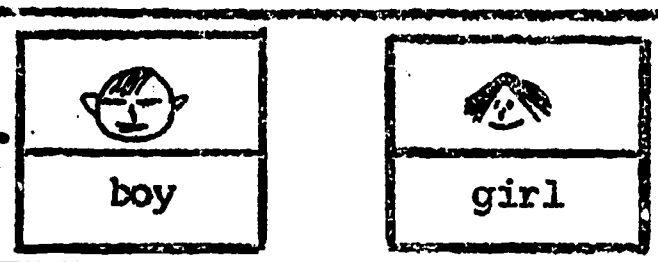
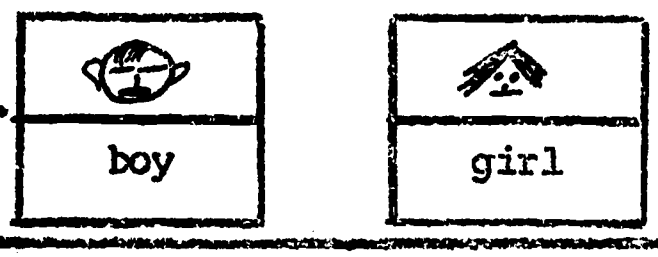
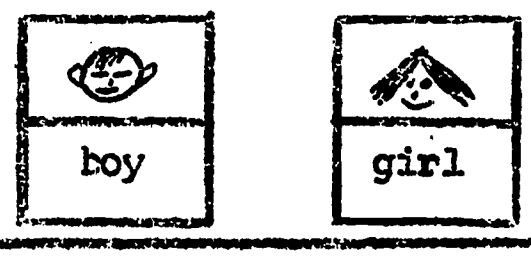
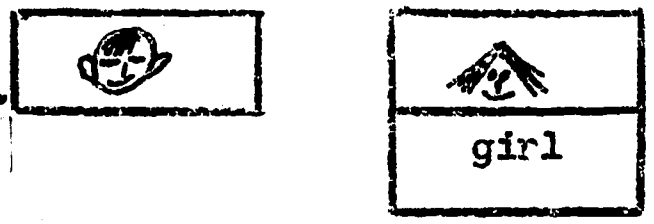
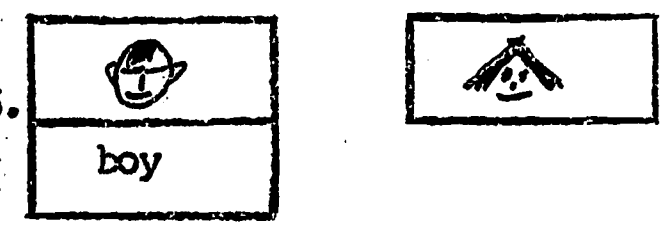
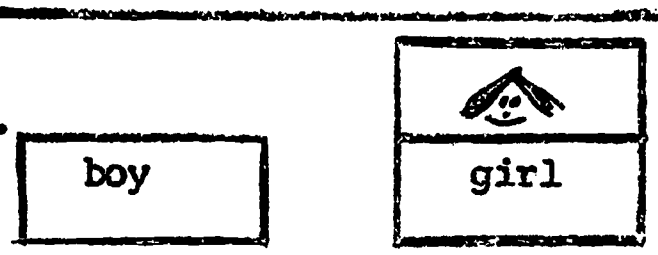
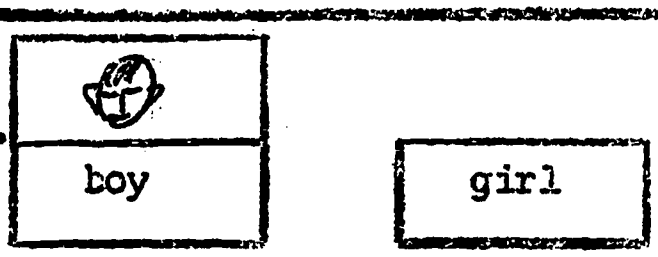
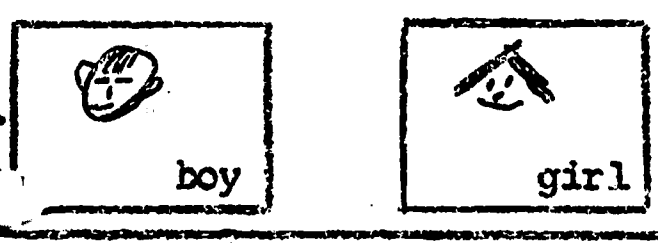
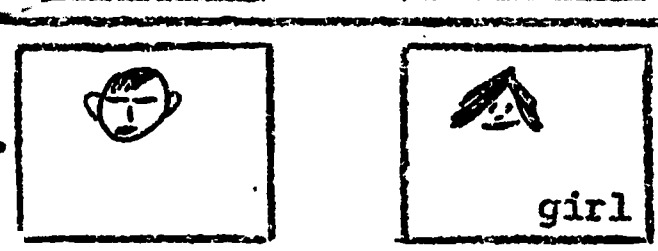
2) To train picture to word matching of "boy" and "girl"

Name _____

BD: _____ C.A. _____

Date: _____

Exmr: _____

STIMULUS ITEMS	RESPONSE ITEMS	TRIALS
 boy / girl		boy / girl
 boy / girl	boy / girl	boy / girl
 boy / girl	 boy / girl	boy / girl
 girl	Same	boy / girl
 boy	Same	boy / girl
 boy / girl	Same	boy / girl
 boy / girl	Same	boy / girl
 boy / girl	boy / girl	boy / girl
 girl	boy / girl	boy / girl

TESTS